RED SEAL

THE INTERPROVINCIAL STANDARDS RED SEAL PROGRAM

National Occupational Analysis

2010 | Steamfitter/Pipefitter

Human Resources and Skills Development Canada
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Canada

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Steamfitter/Pipefitter

2010

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FOREWORD

The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this National Occupational Analysis as the national standard for the occupation of steamfitter/pipefitter.

Background

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to cooperate with provincial and territorial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Human Resources and Skills Development Canada (HRSDC) sponsors a program, under the guidance of the CCDA, to develop a series of National Occupational Analyses (NOAs).

The NOAs have the following objectives:

- to describe and group the tasks performed by skilled workers;
- to identify which tasks are performed in every province and territory;
- to develop instruments for use in the preparation of Interprovincial Red Seal Examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility of apprentices and skilled workers in Canada; and
- to supply employers, employees, associations, industries, training institutions and governments with analyses of occupations.

ACKNOWLEDGEMENTS

The CCDA and HRSDC wish to express sincere appreciation for the contribution of the many tradespersons, industrial establishments, professional associations, labour organizations, provincial and territorial government departments and agencies, and all others who contributed to this publication.

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Bill Stanger	United Association of Plumbers, Pipefitters and Welders

This analysis was prepared by the Workplace Partnerships Directorate of HRSDC. The coordinating, facilitating and processing of this analysis were undertaken by employees of the NOA development team of the Trades and Apprenticeship Division. Greg Shorland for the host jurisdiction of British Columbia also participated in the development of this NOA.

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LIST OF PUBLISHED NATIONAL OCCUPATIONAL ANALYSES (Red Seal Trades)

	NOC* Code
Agricultural Equipment Technician (2007)	7312
Appliance Service Technician (2005)	7332
Automotive Painter (2009)	7322
Automotive Service Technician (2009)	7321
Baker (2006)	6252
Boilermaker (2008)	7262
Bricklayer (2007)	7281
Cabinetmaker (2007)	7272
Carpenter (2010)	7271
Concrete Finisher (2006)	7282
Construction Craft Worker (2009)	7611
Construction Electrician (2008)	7241
Cook (2008)	6242
Electrical Rewind Mechanic (1999)	7333
Electronics Technician – Consumer Products (1997)	2242
Floorcovering Installer (2005)	7295
Glazier (2008)	7292
Hairstylist (2009)	6271
Heavy Duty Equipment Technician (2009)	7312
Industrial Electrician (2008)	7242
Industrial Mechanic (Millwright) (2009)	7311
Instrumentation and Control Technician (2010)	2243
Insulator (Heat and Frost) (2007)	7293
Ironworker (Generalist) (2006)	7264
Ironworker (Reinforcing) (2006)	7264
Ironworker (Structural/Ornamental) (2006)	7264
Landscape Horticulturist (2010)	2225

* National Occupational Classification

TITLE	NOC Code
Lather (Interior Systems Mechanic) (2007)	7284
Machinist (2010)	7231
Metal Fabricator (Fitter) (2008)	7263
Mobile Crane Operator (2009)	7371
Motorcycle Mechanic (2006)	7334
Motor Vehicle Body Repairer (Metal and Paint) (2010)	7322
Oil Burner Mechanic (2006)	7331
Painter and Decorator (2007)	7294
Partsperson (2010)	1472
Plumber (2008)	7251
Powerline Technician (2009)	7244
Recreation Vehicle Service Technician (2006)	7383
Refrigeration and Air Conditioning Mechanic (2009)	7313
Rig Technician (2008)	8232
Roofer (2006)	7291
Sheet Metal Worker (2010)	7261
Sprinkler System Installer (2009)	7252
Steamfitter/Pipefitter (2010)	7252
Tilesetter (2010)	7283
Tool and Die Maker (2005)	7232
Transport Trailer Technician (2008)	7321
Truck and Transport Mechanic (2010)	7321
Welder (2009)	7265

Requests for printed copies of National Occupational Analyses may be forwarded to:

Trades and Apprenticeship Division
Workplace Partnerships Directorate
Human Resources and Social Development Canada
140 Promenade du Portage, Phase IV, 5th Floor
Gatineau, Quebec K1A 0J9

These publications can be ordered or downloaded online at: www.red-seal.ca. Links to essential skills profiles for some of these trades are also available on this website.

STRUCTURE OF ANALYSIS

To facilitate understanding of the occupation, the work performed by tradespersons is divided into the following categories:

Blocks	largest division within the analysis that is comprised of a distinct set of trade activities
Tasks	distinct actions that describe the activities within a block
Sub-Tasks	distinct actions that describe the activities within a task
Key Competencies	activities that a person should be able to do in order to be called 'competent' in the trade

The analysis also provides the following information:

Trends	changes identified that impact or will impact the trade including work practices, technological advances, and new materials and equipment
Related Components	list of products, items, materials and other elements relevant to the block
Tools and Equipment	categories of tools and equipment used to perform all tasks in the block; these tools and equipment are listed in Appendix A
Context	information to clarify the intent and meaning of tasks
Required Knowledge	elements of knowledge that an individual must acquire to adequately perform a task

The appendices located at the end of the analysis are described as follows:

Appendix A — Tools and Equipment	non-exhaustive list of tools and equipment used in this trade
Appendix B — Glossary	definitions or explanations of selected technical terms used in the analysis
Appendix C — Acronyms	list of acronyms used in the analysis with their full name
Appendix D — Block and Task Weighting	block and task percentages submitted by each jurisdiction, and the national averages of these percentages; these national averages determine the number of questions for each block and task in the Interprovincial exam
Appendix E — Pie Chart	graph which depicts the national percentages of exam questions assigned to blocks
Appendix F — Task Profile Chart	chart which outlines graphically the blocks, tasks and sub-tasks of this analysis

DEVELOPMENT AND VALIDATION OF ANALYSIS

Development of Analysis

A draft analysis is developed by a committee of industry experts in the field led by a team of facilitators from HRSDC. This draft analysis breaks down all the tasks performed in the occupation and describes the knowledge and abilities required for a tradesperson to demonstrate competence in the trade.

Draft Review

The NOA development team then forwards a copy of the analysis and its translation to provincial and territorial authorities for a review of its content and structure. Their recommendations are assessed and incorporated into the analysis.

Validation and Weighting

The analysis is sent to all provinces and territories for validation and weighting. Participating jurisdictions consult with industry to validate and weight the document, examining the blocks, tasks and sub-tasks of the analysis as follows:

BLOCKS	Each jurisdiction assigns a percentage of questions to each block for an examination that would cover the entire trade.
TASKS	Each jurisdiction assigns a percentage of exam questions to each task within a block.
SUB-TASKS	Each jurisdiction indicates, with a YES or NO, whether or not each sub-task is performed by skilled workers within the occupation in its jurisdiction.

The results of this exercise are submitted to the NOA development team who then analyzes the data and incorporates it into the document. The NOA provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for block and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

This method for the validation of the NOA also identifies common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions perform a sub-task, it shall be considered common core. Interprovincial Red Seal Examinations are based on the common core sub-tasks identified through this validation process.

Definitions for Validation and Weighting

YES	sub-task performed by qualified workers in the occupation in a specific jurisdiction
NO	sub-task not performed by qualified workers in the occupation in a specific jurisdiction
NV	analysis Not Validated by a province/territory
ND	trade Not Designated in a province/territory
NOT COMMON CORE (NCC)	sub-task, task or block performed by less than 70% of responding jurisdictions; these will not be tested by the Interprovincial Red Seal Examination for the trade
NATIONAL AVERAGE %	average percentage of questions assigned to each block and task in Interprovincial Red Seal Examination for the trade

Provincial/Territorial Abbreviations

NL	Newfoundland and Labrador
NS	Nova Scotia
PE	Prince Edward Island
NB	New Brunswick
QC	Quebec
ON	Ontario
MB	Manitoba
SK	Saskatchewan
AB	Alberta
BC	British Columbia
NT	Northwest Territories
YT	Yukon Territory
NU	Nunavut

ANALYSIS

SAFETY

Safe working procedures and conditions, accident prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and work environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe and accident-free work environment.

It is imperative to apply and be familiar with the Occupational Health and Safety (OH&S) Acts and Workplace Hazardous Materials Information System (WHMIS) Regulations. As well, it is essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

Safety education is an integral part of training in all jurisdictions. As safety is an imperative part of all trades, it is assumed and therefore it is not included as a qualifier of any activities. However, the technical safety tasks and sub-tasks specific to the trade are included in this analysis.

SCOPE OF THE STEAMFITTER/PIPEFITTER TRADE

"Steamfitter/Pipefitter" is this trade's official Red Seal occupational title approved by the CCDA. This analysis covers tasks performed by a steamfitter/pipefitter whose occupational title has been identified by some provinces and territories of Canada under the following names:

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
Pipefitter - Heating System Installer Specialty (Construction)					✓								
Steamfitter						✓							
Steamfitter – Pipefitter							✓		✓				
Steamfitter/Pipefitter	✓	✓	✓	✓				✓		✓	✓	✓	✓

Steamfitters/Pipefitters lay out, assemble, fabricate, maintain, repair and service equipment and piping systems carrying water, steam, fluids, gases, chemicals and fuel in various systems such as heating, cooling, lubricating and process piping systems. They read and interpret drawings, specifications and codes to determine layout, type and size of pipe and tools to use. They measure, cut, thread, groove, bend, solder, braze, assemble and install metal, plastic and fiberglass pipes, valves and fittings. As well, they must be able to join and secure pipe sections of related equipment. They check systems for leaks. Steamfitters/Pipefitters also do general maintenance work including replacement of worn components.

Steamfitters/Pipefitters must carry out quality control checks on work performed. The system must be tested and commissioned to verify the quality of work and to confirm that the system is functioning to design specifications. They use welding, cutting, shaping, soldering, threading and brazing equipment to join pipes and fabricate sections of piping systems.

Areas of specialization in this trade include maintenance, quality control, rigging, fabrication and installation of various types of systems.

Steamfitters/Pipefitters work both indoors and outdoors at physically demanding tasks that often require working at heights. There is some risk of injury when working in and around trenches, on work platforms and with power tools and heavy equipment. The piping systems may carry dangerous substances. Safety practices and training are emphasized in order to minimize risks.

Steamfitters/Pipefitters must have mechanical aptitude, manual dexterity, mathematical skills, an ability to read and understand complex instructions and an ability to do careful and exacting work. They sometimes work in uncomfortable or cramped positions. The work can also be physically demanding.

This analysis recognizes similarities or overlaps with the work of tradespeople such as plumbers, welders, boilermakers, oil heat systems technician, industrial mechanics (millwrights), sprinkler system installers and refrigeration and air conditioning mechanics.

With experience, steamfitters/pipefitters may advance to positions such as foreman, contractor, owner, superintendent and instructor.

OCCUPATIONAL OBSERVATIONS

Steam systems are being installed less frequently in office and commercial facilities. However, these systems are still prevalent in facilities utilizing central heating plants such as hospitals and college/university campuses.

Plastic pipe is increasingly being used in all sectors for certain applications. In industries such a pulp and paper, mining and chemical, there is an increase in the use of specialized materials. New materials are becoming economically feasible, driving changes in structural design, especially in industrial and institutional sectors. The movement to more specialized materials will require more highly skilled steamfitters/pipefitters. This will also require a more in-depth knowledge of quality control procedures.

Renewable energy systems such as geo-thermal, solar, radiant, heat recovery and central cooling plants are becoming more prevalent. There is new technology for water-heating, such as low-mass boilers, on-demand (flow-through) hot water systems, condensing boilers and high efficiency boilers.

Steamfitters/Pipefitters must keep current on a large number of regulations and codes. Governments continue to pass more stringent safety, health and environmental regulations. Steamfitters/Pipefitters are expected to obtain and maintain a high level of safety knowledge and training.

There is an increase in the use of hydraulic/pneumatic/electric cutting and bevelling tools for pipe-end preparation. Hydraulic/pneumatic/electric tensioning and torquing equipment are also becoming more common in the trade.

There is an ongoing trend towards the use of computers for reports, schedules, ordering material, completion of forms, rendering drawings (computer-aided design or CAD), system analysis and service, and control of heating/cooling systems.

In some jurisdictions, steamfitters/pipefitters require specialty licenses such as gas, fuel and oil licences or other special endorsements for working with materials such as medical gas. Certification may also be required for performing electric welding, tacking processes and backflow prevention.

ESSENTIAL SKILLS SUMMARY

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace changes.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

The tools are available online or for order at: www.hrsdc.gc.ca/essentialskills

The essential skills profile for the steamfitter/pipefitter trade indicates that the most important essential skills are **document use**, **numeracy** and **working with others**.

The application of these skills may be described throughout this document within the competency statements which support each subtask of the trade. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

Reading
Steamfitters/Pipefitters require strong reading skills to refer to manufacturers' manuals and instructions including diagrams, charts and graphs. Steamfitters/Pipefitters also need to consult multiple professional codes concerning industry standards and safety requirements.

Document Use
Steamfitters/Pipefitters must be comfortable in document use to interpret work schedules. They consult reference manuals on measurement, materials and pipe sizing, pressures and mathematical formulas for calculations. They interpret information from mechanical drawings, schematic diagrams and architectural plans to ensure proper installation of piping. They also use quality control documentation which records information such as heat numbers, weld mapping and material identification.

Writing
Writing skills are used by steamfitters/pipefitters to write lists of materials and fittings needed for a job, complete forms to request materials and keep daily logs to record measurements and reminders. When required, they must write incident or accident reports.

Oral Communication
Steamfitters/Pipefitters require good oral communication skills to interact with colleagues, supervisors and other tradespersons when co-ordinating work, resolving problems and ensuring safety. They interact with apprentices to provide mentorship and speak with vendors to order materials.

Numeracy
Numeracy skills are very important in the everyday work of steamfitters/pipefitters. They frequently take or calculate measurements of temperature, pressure and volume. They verify conformity with manufacturers' recommendations and operating practices. The work requires a strong understanding of mathematical calculations and trigonometry. The ability to estimate the quantity of piping material required and to convert between Imperial and Metric systems of measurement is also important.

Thinking Skills
Steamfitters/Pipefitters identify the steps and develop a plan to accomplish a task and coordinate the work. They must decide how to configure and relocate pipes. The ability to problem-solve during testing or when a pipe or system failure is encountered is important. Decision making is important when considering job safety and risk prevention. Steamfitters/Pipefitters must also be able to find information they need in multiple sources such as blueprints, code documents, reference manuals and product catalogues.

Working with Others
Steamfitters/Pipefitters liaise with supervisors, colleagues and other trades to coordinate multiple tasks. They may work with trades such as welders, pipe insulators and electricians. They supervise others and mentor apprentices, offering both practical training and safety information.

Computer Use
Steamfitters/Pipefitters may use communications software for e-mail or use the Internet to look up material information or to order materials on-line. They may use a spreadsheet to keep track of the status of materials ordered. They may also use computer-aided design (CAD) software to input measurements taken on the job site to generate drawings and for referencing purposes.

Continuous Learning
Steamfitters/Pipefitters may pursue refresher courses or specialty certifications and attend supplier seminars. Continuous learning is essential as they must keep up-to-date with the regulatory requirements and the various codes that are periodically revised. Also, they must keep abreast of technological advances in their field to select the most appropriate equipment and materials and be able to perform a proper installation.

BLOCK A OCCUPATIONAL SKILLS

Trends

The steamfitter/pipefitter trade is continually adapting to industry needs, technological advancements and more stringent safety requirements. Computer use for generating and communicating information is continuously evolving within the industry. There is an increase in quality control, mainly for accountability and traceability issues pertaining to piping, fittings and welding procedures. Better personal protective equipment (PPE) is becoming available such as anti-vibration gloves in order to prevent hand-arm vibration syndrome. Propane handling tickets are now required in some jurisdictions. Certification may be required by manufacturers, owners or jurisdictions to work on certain equipment and material.

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 1 Performs safety-related functions.

Context

Safety is integral to any and every aspect of the steamfitter/pipefitter trade. Steamfitters/Pipefitters maintain a safe work environment in order to prevent and correct any potential or immediate hazard, address an incident or accident, and follow up to ensure the safety and wellness of every person on the work site. The use and maintenance of PPE and safety equipment are essential to every job.

Required Knowledge

K 1	types of PPE such as fall arrest harnesses, respirators and face shields
K 2	types of safety equipment such as fire extinguishers, first aid kits and fume extractors
K 3	PPE and safety equipment operating procedures
K 4	training requirements for PPE and safety equipment
K 5	locations of PPE and safety equipment
K 6	workplace safety and health regulations such as WHMIS and Material Safety Data Sheets (MSDS)

K 7	OH&S Acts
K 8	jurisdictional and company requirements for training and certification such as first aid confined space and fall arrest
K 9	work site hazards such as overhead hazards, confined space hazards, hot work hazards, noise hazards, environmental hazards, vibration hazards and air quality hazards

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Sub-task

A-1.01 **Maintains safe work environment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.01.01	participate in tool box meetings
A-1.01.02	plan pre-hazard assessments before performing each task
A-1.01.03	reference safety regulations
A-1.01.04	install temporary safety protection such as lock-out and tag-out devices
A-1.01.05	handle and store hazardous materials
A-1.01.06	recognize unsafe conditions
A-1.01.07	report hazards by contacting the Health and Safety representative and supervisor immediately
A-1.01.08	address or correct the hazard with methods such as roping off the area or removing the hazardous item
A-1.01.09	communicate hazards to co-workers
A-1.01.10	keep workplace tidy and organized (housekeeping)
A-1.01.11	refer to MSDS
A-1.01.12	comply with company or jurisdictional procedures for emergency response

Sub-task

A-1.02 **Uses personal protective equipment (PPE) and safety equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.02.01	select PPE and safety equipment for task
A-1.02.02	maintain PPE and safety equipment by cleaning and ensuring it is in good condition
A-1.02.03	identify and replace worn, damaged or defective PPE and safety equipment
A-1.02.04	store PPE and safety equipment according to manufacturers' recommendations
A-1.02.05	inspect for proper function, expiration date and fit of PPE and safety equipment
A-1.02.06	connect, tie or hook fall-protection and fall-arrest equipment according to manufacturers' and engineered specifications
A-1.02.07	ensure fall-protection and fall-arrest equipment is recertified according to jurisdictional policy

Task 2 Uses and maintains tools and equipment.

Context Tools and equipment must be used, maintained and stored in a safe manner to complete all tasks of the steamfitter/pipefitter trade. Ladders and work platforms are often required to access job locations. Steamfitters/Pipefitters perform welding and soldering tasks including electric arc welding, gas welding, solvent welding and heat fusion welding. They must be knowledgeable in setting up the welding, soldering, brazing and oxy-fuel equipment, in actual welding practices, pipe preparation and cure times.

Required Knowledge

K 1	types of tools such as wrenches and pliers
K 2	hand tool operating procedures and limitations
K 3	types of power tools such as electrical, pneumatic, hydraulic and powder-actuated tools
K 4	power tool operating procedures and limitations

K 5	types of measuring tools such as tape, ruler and manometer
K 6	measuring tool operating procedures and limitations
K 7	pipe trade measurements such as end-to-centre, end-to-end and face-to-centre
K 8	types of welding equipment such as shielded metal arc welding (SMAW), tungsten inert gas (TIG) and gas metal arc welding (GMAW)
K 9	alloys and fluxes
K 10	types of soldering and brazing equipment such as acetylene torch and attachments such as strikers
K 11	brazing alloys and fluxes such as BCuP and BAg alloys (Sil-Phos™ and silver solder)
K 12	jurisdictional certification and training requirements for brazing
K 13	types of ladders such as step ladders, extension ladders and platform ladders
K 14	operating procedures and limitations of ladders according to jurisdictions, companies and manufacturers
K 15	types of work platforms such as scaffolds and manlifts
K 16	operating procedures and regulations of work platforms

Sub-task

A-2.01 Uses ladders and work platforms.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.01.01	select ladders and work platforms
A-2.01.02	perform visual inspection of ladders and work platforms prior to and during use
A-2.01.03	secure ladders and work platforms according to jurisdictional guidelines
A-2.01.04	identify, tag and replace worn, damaged or defective ladders and work platforms
A-2.01.05	store ladders and work platforms
A-2.01.06	check expiration dates for work platforms
A-2.01.07	obtain aerial platform training according to company policy and jurisdictional requirements

Sub-task

A-2.02 Maintains tools and equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.02.01	clean, lubricate and sharpen tools and equipment
A-2.02.02	perform visual inspection before using tools and equipment
A-2.02.03	identify, tag, replace or perform minor repairs on worn, damaged or defective tools
A-2.02.04	inspect and store tools and equipment
A-2.02.05	follow scheduled maintenance procedures for tools and equipment

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Sub-task

A-2.03 Uses welding equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.03.01	assist in the selection of welding equipment
A-2.03.02	handle consumables such as welding rods, flux and grinding disks according to quality control requirements
A-2.03.03	match alloys to specific components to be welded
A-2.03.04	assist in setting up machine according to application
A-2.03.05	protect flammable materials while welding
A-2.03.06	perform tack welding
A-2.03.07	maintain welding equipment by performing visual inspections
A-2.03.08	identify, tag, replace or perform minor repairs on worn, damaged or defective welding equipment
A-2.03.09	store welding equipment

Sub-task

A-2.04 Uses soldering and brazing equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.04.01	select soldering and brazing equipment such as type of torch and torch heads
A-2.04.02	set up soldering and brazing equipment according to application
A-2.04.03	match alloys to specific components to be soldered or brazed
A-2.04.04	select flux and solder according to application
A-2.04.05	join piping system components such as pipes, fittings and valves
A-2.04.06	protect flammable materials while soldering and brazing
A-2.04.07	maintain soldering and brazing equipment
A-2.04.08	identify, tag and replace or repair worn, damaged or defective soldering and brazing equipment
A-2.04.09	store soldering and brazing equipment
A-2.04.10	store fuel cylinders according to specifications

Sub-task

A-2.05 Uses oxy-fuel equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.05.01	select oxy-fuel equipment such as flashback arrestors and regulators
A-2.05.02	set up oxy-fuel gauges and torches according to application
A-2.05.03	select tips according to application and fuel use
A-2.05.04	protect flammable materials while operating oxy-fuel equipment
A-2.05.05	match alloys to specific components to be joined
A-2.05.06	pre-heat using oxy-fuel equipment according to jurisdictional regulations
A-2.05.07	fabricate and bend hangers and brackets
A-2.05.08	cut, bevel and bend pipe
A-2.05.09	maintain oxy-fuel equipment

A-2.05.10	identify, tag and replace or repair worn, damaged or defective oxy-fuel equipment
A-2.05.11	store oxy-fuel equipment

Task 3 Organizes work.

Context Steamfitters/Pipefitters need to organize their work by planning the job, generating material lists and managing their time to meet project deadlines. They ensure the system is assembled correctly by following regulations and specifications, and implementing quality control practices.

Required Knowledge

K 1	assigned work to be performed
K 2	work performed by other tradespersons
K 3	types of documentation such as codes, regulations, checklists, charts, work orders, tool manuals and manufacturers' installation guides
K 4	permits such as hot work, cold work and work in confined space
K 5	piping and fitting symbols
K 6	control symbols
K 7	joining symbols
K 8	grades and sizes of piping
K 9	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications
K 10	material ratings such as 150, 300, 600 and 900 lb, and their applications
K 11	types of fasteners
K 12	types of hangers, supports, guides and anchors
K 13	types of non-destructive testing (NDT)

Sub-task

A-3.01 Plans a job.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-3.01.01	identify task
A-3.01.02	identify sequence of tasks
A-3.01.03	identify tools, piping, equipment and components required for task
A-3.01.04	estimate time and labour requirements to complete tasks
A-3.01.05	coordinate work with other trades
A-3.01.06	coordinate schedule
A-3.01.07	adapt to changing environmental conditions
A-3.01.08	prepare work area such as installing temporary shelters, platforms and heaters to maintain stable work conditions
A-3.01.09	expedite tools, material and spool pieces to installation location

Sub-task

A-3.02 Generates material list.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-3.02.01	reference codes, drawings and specifications for types of piping and components
A-3.02.02	illustrate 3 dimensional visualization through methods such as modeling and isometric drawing
A-3.02.03	select piping and components
A-3.02.04	organize and compile information

Sub-task

A-3.03 Performs quality control functions.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-3.03.01	use quality control documentation such as manuals, daily reports and mill test reports
A-3.03.02	apply codes, specifications and engineered drawings
A-3.03.03	identify piping materials
A-3.03.04	perform testing such as vacuum, hydrostatic and pneumatic
A-3.03.05	reference weld procedures
A-3.03.06	transfer heat numbers and welder I.D. numbers
A-3.03.07	document material for traceability
A-3.03.08	verify the types of piping within the system
A-3.03.09	compile turnover documentation
A-3.03.10	verify the integrity of coating for piping assemblies and components
A-3.03.11	apply minor heat treating and stress relieving techniques to ensure the integrity of the weld
A-3.03.12	verify torque requirements
A-3.03.13	apply recommended coating to welded joints on stainless steel to prevent weld contamination
A-3.03.14	perform visual inspection of entire system to ensure compliance with specifications
A-3.03.15	arrange for X-ray inspection of welded joints and piping according to specifications
A-3.03.16	arrange for NDT such as magnetic particle and dye penetrant according to specifications
A-3.03.17	arrange for ultrasonic test on pipelines and fittings to verify thickness
A-3.03.18	generate as-built drawings at completion of job
A-3.03.19	submit documentation such as vendor drawings, as-built drawings and operational manuals to authorities having jurisdiction (AHJ)

BLOCK B DRAWINGS AND SPECIFICATIONS

Trends	There is an increase in the use of computer-generated drawings. While it is still a trade skill, it is less common for steamfitters/pipefitters to create their own hand-drawn templates.
Related Components (include, but not limited to)	**Drawings:** architectural, structural, mechanical, electrical, isometric, orthographic, oblique, detail, manufacturers', process and instrumentation drawings (P&ID), spool sheets, site plans, blueprints, material list, project specifications, as-built.
Tools and Equipment	Drafting tools, precision layout tools, templates.

Task 4 Interprets drawings and specifications.

Context Steamfitters/Pipefitters use drawings and specifications to determine scope of work, and materials and methods to be used for specific installations.

Required Knowledge

K 1	sections of specifications
K 2	types of drawings such as mechanical, structural, architectural and P&ID
K 3	abbreviations and drafting symbols such as lines, weld symbols, piping and fitting symbols, and control symbols
K 4	ordinate lines, elevations and benchmarks
K 5	piping and equipment layout
K 6	applicable codes
K 7	types and grades of piping materials

Sub-task

B-4.01 Compares specifications to drawings.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-4.01.01	verify accuracy of specifications compared to the drawings to select material required for installation
B-4.01.02	transfer information from specifications to drawings
B-4.01.03	communicate discrepancies with authorities such as supervisor or engineer
B-4.01.04	identify drawing revisions
B-4.01.05	reference codes with specifications to ensure specification meets minimum code requirements

Sub-task

B-4.02 Refers to types of drawings.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-4.02.01	gather information from multiple drawings such as structural, architectural, P&ID, and general arrangement drawings
B-4.02.02	determine dimensions using tools such as rulers and calculators
B-4.02.03	reference spool drawings to identify scope of work, fabricate piping and components, and install systems
B-4.02.04	illustrate three-dimensional visualization using drawings such as orthographic and isometric
B-4.02.05	identify types of piping systems from drawings
B-4.02.06	determine location of piping and equipment
B-4.02.07	interpret equipment layout drawings, vendor drawings and mechanical drawings
B-4.02.08	relate line numbering systems to drawings

Task 5 — Produces drawings.

Context Steamfitters/Pipefitters develop drawings in order to communicate detailed construction information such as dimensions, materials used and joining methods. Drawing is also used in the development of templates, which are used in the layout and fabrication of fittings such as mitres and branch connections.

Required Knowledge

K 1	isometric and orthographic drawings
K 2	schematic drawings
K 3	geometry and trigonometry
K 4	isometric axis
K 5	types of templates
K 6	types of fittings
K 7	trade-related symbols

Sub-task

B-5.01 Generates drawings.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-5.01.01	select and use layout and drafting tools and equipment such as builders levels (transit), squares and compasses
B-5.01.02	sketch types of drawings such as isometric, spool drawings and schematics
B-5.01.03	apply trade-related symbols to sketches
B-5.01.04	create as-built drawings to illustrate final installation

Sub-task

B-5.02 Develops templates.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-5.02.01	identify required template such as tee, wye and mitre
B-5.02.02	select and use drafting tools and equipment such as squares and compasses
B-5.02.03	gather information from reference material such as trade books, charts and diagrams
B-5.02.04	transfer information from specifications to template

BLOCK C LAYOUT, FABRICATION AND INSTALLATION

Trends

In some areas, there is an increase in pre-fabrication as modularization is becoming more common and resulting in increased efficiency. There is a decrease in the manual development of templates. Alternative materials are becoming more commonplace which encompasses higher quality control standards. There is a trend in new installations for glycol-based tracing systems rather than steam tracing.

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 6 Performs layout and fabrication.

Context

Prior to installation of piping and equipment, steamfitters/pipefitters perform layout and fabrication either in an off-site fabrication shop or on-site.

Required Knowledge

K 1	types of drawings
K 2	styles of templates
K 3	types of pipe such as stainless steel, chrome, copper nickel, polyvinyl chloride (PVC), fibreglass reinforced plastic (FRP), high density polyethylene (HDPE), cast iron, carbon steel and cross linked polyethylene (PEX)
K 4	types of fittings
K 5	layout techniques such as calculating cut lengths, offsets and mitres
K 6	fabrication techniques such as cutting, bending, threading, grooving and bevelling
K 7	assembly techniques such as alignment, fitting allowances, grading, two-holing and squaring
K 8	types of protective coatings
K 9	welding rod management
K 10	quarantine area

K 11	torquing and tensioning
K 12	stress relieving
K 13	temperature requirements for working with materials
K 14	NDT

Sub-task

C-6.01 Lays out pipe and fittings.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-6.01.01	select and use tools and equipment such as drafting and layout tools
C-6.01.02	conduct quality control functions such as verifying material and consumables, and documenting heat numbers and mill stock numbers
C-6.01.03	quarantine to prevent cross contamination
C-6.01.04	determine layout based on instructions from drawings or verbal direction
C-6.01.05	determine thickness of insulation
C-6.01.06	perform and check calculations
C-6.01.07	prepare material list
C-6.01.08	determine field weld locations
C-6.01.09	take field measurements
C-6.01.10	define ordinates on piping

Sub-task

C-6.02 Fabricates piping spools.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-6.02.01	select and use tools and equipment such as pipe stands, pipe vises and flange squares
C-6.02.02	check material list to ascertain material quantities

C-6.02.03	prepare piping and fittings for methods such as threading, grooving, gluing, welding, compression and fusion
C-6.02.04	treat pipe using methods such as applying protective coatings and chemically treating
C-6.02.05	prepare fit-up for two-holing and fitting tolerance such as gap, high-low, transitioning and alignment
C-6.02.06	pre-heat or purge piping material
C-6.02.07	perform post fit-up such as stress relieving or controlled cooling according to jurisdictional requirements
C-6.02.08	check completed work for conformity to specifications
C-6.02.09	generate drawing where none exists
C-6.02.10	document weld mapping
C-6.02.11	itemize joints and pieces on spools and cross reference to drawings
C-6.02.12	torque fabricated piping
C-6.02.13	test fabricated piping using methods such as hydro and pneumatic

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Sub-task

C-6.03 **Fabricates brackets, supports, hangers, guides and anchors.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-6.03.01	select and use tools and equipment
C-6.03.02	determine support based on instructions from drawings or verbal direction
C-6.03.03	generate material list
C-6.03.04	determine thickness of insulation
C-6.03.05	generate drawing where none exists
C-6.03.06	determine field weld locations
C-6.03.07	take field measurements
C-6.03.08	prepare support for methods such as welding, threading and bolting
C-6.03.09	torque fabricated supports
C-6.03.10	perform post fit-up such as stress relieving or controlled cooling according to jurisdictional requirements
C-6.03.11	check completed work for conformity to specifications

C-6.03.12	itemize supports and cross reference to drawings
C-6.03.13	document field weld locations

Task 7 — Performs common installation processes.

Context Steamfitters/Pipefitters are responsible for installing supports and hangers, as well as piping assemblies and components for piping systems. The installation process encompasses installing pre-fabricated pieces as well as making field runs. Steamfitters/Pipefitters are faced with situations where the materials they are working with may need to be handled in ways such as isolating and quarantining. These tasks are common across the trade in the installation of all types of systems.

Required Knowledge

K 1	types of supports and hangers
K 2	types of guides and anchors
K 3	piping material being supported such as fibreglass, copper and alloy
K 4	piping contents to be supported
K 5	types of fasteners
K 6	joining techniques such as plastic fusion, welding, soldering and brazing, grooving and threading
K 7	approved jointing compounds for piping system
K 8	alignment procedures
K 9	torquing and tensioning procedures
K 10	expansion and contraction
K 11	types of components and equipment such as boiler trim, valves, temperature indicators, backflow preventers and compressors
K 12	controls in reference to P&ID
K 13	system operating parameters
K 14	piping materials
K 15	piping practices and procedures associated with specific piping materials
K 16	system medium such as water, steam or oil
K 17	flow characteristics
K 18	connection points
K 19	respective endorsements pertaining to manufacturers' or jurisdictional requirements

Sub-task

C-7.01 Installs piping system components and equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-7.01.01	select and use tools and equipment such as pipe stands, rigging and flange squares
C-7.01.02	cross reference packing list and drawings
C-7.01.03	reference manufacturers' installation instructions
C-7.01.04	prepare spools for installation such as facing-up ends and gathering studs, nuts and gaskets for placement of components
C-7.01.05	prepare fit-up for two-holing and fitting tolerance such as gap, high-low and alignment
C-7.01.06	pre-heat or purge piping material
C-7.01.07	install expansion joints, swing joints and expansion loops
C-7.01.08	install components such as flow control valves, gauges, back-flow prevention and pressure relief valves
C-7.01.09	join pipe using techniques such as plastic fusion, welding, soldering and brazing, grooving and threading
C-7.01.10	align and level
C-7.01.11	perform post fit-up such as stress relieving or controlled cooling according to jurisdictional requirements
C-7.01.12	check completed work for conformity to specifications
C-7.01.13	generate drawing where none exists
C-7.01.14	document weld mapping
C-7.01.15	itemize joints and pieces on spools and cross reference to drawings
C-7.01.16	torque fabricated piping
C-7.01.17	treat pipe using methods such as applying protective coatings and chemically treating
C-7.01.18	test fabricated piping using methods such as hydro and pneumatic

Sub-task

C-7.02 Installs brackets, supports, hangers, guides and anchors.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-7.02.01	select and use tools and equipment
C-7.02.02	determine field weld locations
C-7.02.03	take field measurements using methods such as calculating space, grade and elevation
C-7.02.04	determine thickness of insulation
C-7.02.05	recognize interferences
C-7.02.06	prepare component for joining methods such as welding, threading and bolting
C-7.02.07	attach brackets, supports, hangers, guides and anchors to building structure according to jurisdictional requirements
C-7.02.08	torque fabricated supports
C-7.02.09	reference support details
C-7.02.10	perform post fit-up such as stress relieving or controlled cooling according to jurisdictional requirements
C-7.02.11	check completed work for conformity to specifications
C-7.02.12	generate drawing where none exists
C-7.02.13	itemize supports and cross reference to drawings
C-7.02.14	document field weld locations

Task 8 Installs tracing systems.

Context Tracing accompanies existing piping systems to facilitate the delivery of the medium. Tracing systems are made with a variety of pipes such as stainless steel and copper. Steamfitters/Pipefitters install, attach, diagnose, repair and energize tracing systems. These systems can be installed during construction or after completion. In liquid-filled tracing systems, water, glycol or a combination of both is used as a medium when consistent temperature control is required. Steam is used when high levels of heat energy are required.

Required Knowledge

K 1	tracing mediums and pipe
K 2	energy delivery methods such as conduction and convection
K 3	installation and joining methods
K 4	dangers of tracing medium
K 5	tracing principles
K 6	steam traps
K 7	pumps
K 8	insulation methods and principles
K 9	application limitations of each medium
K 10	environmentally sound use and handling of mediums used in tracing systems
K 11	medium composition of various tracing systems such as steam, water and glycol

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Sub-task

C-8.01 Installs steam tracing.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-8.01.01	select and use tools and equipment such as benders, and flaring and strapping devices
C-8.01.02	determine amount and type of material needed to perform task according to engineered drawings

C-8.01.03	join piping by methods such as welding, soldering, swaging, brazing, compression and flaring according to jurisdictional requirements
C-8.01.04	attach tracing to piping for the medium using methods such as banding, welding and cementing
C-8.01.05	install components such as valves and traps on systems according to engineered drawings
C-8.01.06	test system using testing methods such as air, service, hydrostatic and visual inspection
C-8.01.07	energize system

Sub-task

C-8.02 Installs liquid-filled tracing systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-8.02.01	select and use tools and equipment such as benders, and flaring and strapping devices
C-8.02.02	determine amount and type of material needed to perform task according to engineered drawings
C-8.02.03	join piping by methods such as welding, soldering, swaging, brazing, compression and flaring
C-8.02.04	integrate the tracing system with a hot water or glycol system
C-8.02.05	attach tracing to piping for the medium using methods such as banding, welding and cementing
C-8.02.06	install components such as valves, pumps and high point vents on systems according to engineered drawings
C-8.02.07	test system using testing methods such as air, service, hydrostatic and visual inspection
C-8.02.08	energize and bleed system
C-8.02.09	handle and dispose of liquid medium

BLOCK D RIGGING AND HOISTING

Trends There is an increased use of larger capacity compact cranes, engineered lifts and forklifts. There are more requirements for rigging training and certification.

Related Components All components apply.

Tools and Equipment See Appendix A.

Task 9 Plans lift.

Context In order to plan a lift, steamfitters/pipefitters must be able to determine the load, select all rigging and hoisting equipment, and conduct these actions in a safe manner.

Required Knowledge

K 1	weights and measures
K 2	types of loads such as equipment and piping
K 3	requirements for engineered lifts
K 4	rigging and hoisting methods
K 5	types of rigging equipment such as chain falls, come-alongs, shackles, slings and spreader bars
K 6	types of hoisting equipment such as tuggers, cranes and grip hoists (Tirfors™)
K 7	principles of mechanical advantage
K 8	load balancing requirements and centre of gravity
K 9	height and weight limitations
K 10	rigging and hoisting equipment restrictions
K 11	direction of lift
K 12	ropes, knots and hitches
K 13	training requirements for rigging and hoisting
K 14	material and equipment weight tables
K 15	lifting and hoisting hand signals

Sub-task

D-9.01 Determines load.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-9.01.01	calculate load weight
D-9.01.02	measure load dimensions
D-9.01.03	determine centre of gravity
D-9.01.04	assess load requirements such as rigging equipment and capacity

Sub-task

D-9.02 Selects rigging and hoisting equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-9.02.01	match lift requirements to rigging and hoisting equipment such as wire rope, shackles, nylon slings, softeners and tag line
D-9.02.02	reference rigging tables and load charts to determine safe working load
D-9.02.03	determine equipment capacity to ensure that all rigging equipment meets load requirements

Sub-task

D-9.03 Prepares lift plan.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-9.03.01	discuss and document with rigging crew to decide on communication strategy such as using hand signals, radio communication and a signaller
D-9.03.02	ensure work area is clear of obstructions and personnel
D-9.03.03	identify new and existing hazards such as blind spots, power lines, overhead piping and live equipment
D-9.03.04	assess weather conditions such as rain, high winds, snow and lightning
D-9.03.05	participate in dry run of hoisting equipment to ensure lift plan is accurate

Task 10 Hoists load.

Context Steamfitters/Pipefitters may work in cooperation with crane operators to set up equipment and perform a lift. They must also be able to conduct equipment inspection (except for cranes) and store equipment in a safe manner.

Required Knowledge

K 1	lift radius, obstructions and load
K 2	types of rigging equipment such as chain falls, come-alongs, shackles, slings and tag line
K 3	types of hoisting equipment such as tuggers, cranes, forklifts and grip hoists (Tirfors™)
K 4	shop drawings and vendor drawings
K 5	attachment procedures
K 6	size of load
K 7	load balancing requirements and centre of gravity
K 8	environmental conditions
K 9	rigging communication method
K 10	rigging terminology

K 11	equipment inspection techniques
K 12	storage procedures and conditions
K 13	jurisdictional training requirements to operate equipment such as overhead cranes and forklifts

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Sub-task

D-10.01 Conducts rigging and hoisting equipment inspection.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-10.01.01	detect equipment faults such as rips, tears, cracks, frayed wire rope and worn shackles
D-10.01.02	check for certification on equipment such as chain-falls and tuggers
D-10.01.03	assess, tag, report and remove damaged equipment from service
D-10.01.04	document regular inspection requirements

Sub-task

D-10.02 Secures lift area.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-10.02.01	identify swing radius and potential obstructions
D-10.02.02	restrict access to lift area and path of travel using barrier tape, barricades and signage
D-10.02.03	communicate lift to others

Sub-task

D-10.03 Sets up rigging equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-10.03.01	determine method of connecting rigging equipment such as hooks, basket hitch and choker hitch
D-10.03.02	attach rigging equipment to load to ensure a safe lift
D-10.03.03	determine placement of equipment on load considering centre of gravity, lifting points, size and shape of load
D-10.03.04	tie knots such as bow line, cat's paw, clove hitch and half hitch
D-10.03.05	attach tag line to orientate and stabilize the lift

Sub-task

D-10.04 Performs lift.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-10.04.01	perform test lift in order to balance load and ensure centre of gravity
D-10.04.02	use hand signals or electronic communication devices to communicate with operator and workers
D-10.04.03	use tag lines to orientate and stabilize load
D-10.04.04	transfer load to other rigging equipment for final placement of load
D-10.04.05	place (land) load and secure in location using methods such as bolting and lashing

Sub-task

D-10.05 Stores equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-10.05.01	organize equipment according to size and capacity
D-10.05.02	clean and lubricate equipment such as chain falls, come-alongs and grip hoists (Tirfors™) according to manufacturers' specifications
D-10.05.03	protect rigging and lifting equipment from elements such as weather, temperature and chemicals
D-10.05.04	refer to manufacturers' recommendations for storage

BLOCK E — STEAM SYSTEM INSTALLATION

Trends

There is a trend in using steam more in process and less in heating. There is also an increase in co-generation power plants using steam.

Related Components (include, but not limited to)

Boilers, burners, backflow preventers, pumps, vessels, heat exchangers, converters, condensate return systems, deaerators, expansion joints, heaters, injectors, instrumentation controls, supports, tanks, traps, turbines, valves, piping, hangers, guides, anchors, brackets, sleeves, tubing, headers, blinds, drains, vents, gauges, dummy legs, knee brace, seismic restraints, steam kettles, steam dryers, steam separators, steam drums, sterilizers, humidifiers, autoclaves, superheaters, desuperheaters, drip leg, strainers, unions, soot blower, heat transfer unit, pressure relief valves.

Tools and Equipment

See Appendix A.

Task 11 — Installs low pressure process steam systems.

Context

Steamfitters/Pipefitters install process equipment and piping in industrial locations such as pulp mills, mines and commercial settings. Processes that use low pressure steam include indirect water heating and direct heating. Low pressure process steam applications include sterilization, humidification, autoclave and steam table (such as for cafeterias).

Required Knowledge

K 1	low pressure steam equipment such as steam kettles, steam dryers and autoclaves
K 2	condensate removal systems
K 3	dangers associated with low pressure steam
K 4	thermodynamics of low pressure steam
K 5	grades and sizes of pipe and fittings
K 6	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications
K 7	material ratings such as 150, 300, 600 and 900 lb, and their applications

K 8	low pressure steam components such as pressure reducing stations, steam traps and pressure relief valves
K 9	expansion and contraction of pipe
K 10	applications for process with low pressure steam such as sterilization, process heating and humidification
K 11	piping materials such as alloy steel, copper and carbon steel
K 12	approved jointing compounds for low pressure steam system piping

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Sub-task

E-11.01 **Installs equipment for low pressure process steam.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-11.01.01	select and use tools and equipment such as threading machine, and brazing and soldering tools
E-11.01.02	select equipment according to load and demand
E-11.01.03	determine location of equipment such as water treatment, condensate tank, boiler, traps and expansion joints according to specifications and drawings
E-11.01.04	set equipment according to industry standards and manufacturers' specifications, engineered drawings and jurisdictional requirements
E-11.01.05	install equipment supports and fasteners to engineering and manufacturers' specifications

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Sub-task

E-11.02 **Installs piping for low pressure process steam.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-11.02.01	select and use tools and equipment such as threading machines, welders and pipe wrenches
E-11.02.02	determine type of piping and fittings such as stainless steel, carbon steel and pre-insulated tubing according to load and engineered drawings

E-11.02.03	determine method for fabrication of joints
E-11.02.04	select and determine location of steam traps according to engineered drawings and piping practices in order to ensure system efficiency and functionality
E-11.02.05	calculate grade or pitch of piping according to engineered drawings and piping practices in order to ensure system efficiency and functionality
E-11.02.06	assess routing to ensure compliance with drawings and avoid interferences
E-11.02.07	install piping supports and brackets
E-11.02.08	assemble piping according to jurisdictional codes, engineered drawings and specifications using joining methods such as threading and welding
E-11.02.09	allow for insulation of steam lines using methods such as sleeving and proper spacing

Task 12 — Installs high pressure process steam systems.

Context Steamfitters/Pipefitters install process equipment and piping in industrial locations such as refineries, pulp mills, mines, commercial settings and power process plants. Processes that use high pressure steam include running turbines, indirect water heating and soot blowers.

Required Knowledge

K 1	high pressure steam equipment such as deaerator tanks and soot blowers
K 2	applications for high pressure process such as turbines
K 3	condensate removal systems and feedwater pumping systems
K 4	thermodynamics of high pressure steam
K 5	dangers associated with high pressure steam
K 6	equipment isolation components such as double-block-and-bleed
K 7	piping materials used for process such as carbon steel and alloy steel
K 8	grades and sizes of pipe and fittings
K 9	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications
K 10	material ratings such as 150, 300, 600 and 900 lb, and their applications
K 11	components such as pressure reducing stations and pressure relief valves
K 12	applications and dangers of superheated steam
K 13	coefficients of expansion

K 14	applications for process with high pressure steam such as process heating, power generation, process piping and oil extraction
K 15	condensate blow down tanks
K 16	steam injection systems
K 17	approved jointing compounds for high pressure steam system piping

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Sub-task

E-12.01 Installs equipment for high pressure process steam.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-12.01.01	select tools and equipment such as threading machines, torquing equipment and welding tools
E-12.01.02	determine location of equipment such as water treatment equipment, condensate tank, boiler, traps and expansion joints according to specifications and drawings
E-12.01.03	set equipment according to industry standards and manufacturers' specifications, engineered drawings and jurisdictional requirements
E-12.01.04	install equipment supports and fasteners to engineering and manufacturers' specifications

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Sub-task

E-12.02 Installs piping for high pressure process steam.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-12.02.01	select and use tools and equipment such as threading machines, welders, torquing equipment and pipe wrenches
E-12.02.02	determine type of piping and fittings according to engineered drawings
E-12.02.03	determine method of fabrication of joints
E-12.02.04	determine location of steam traps according to engineered drawings and piping practices in order to ensure system efficiency and functionality

E-12.02.05	calculate grade or pitch of piping according to engineered drawings and piping practices in order to ensure system efficiency and functionality
E-12.02.06	assess routing to ensure compliance with drawings and avoid interferences
E-12.02.07	install piping, supports and brackets
E-12.02.08	allow for insulation of steam lines using methods such as sleeving and proper spacing
E-12.02.09	assemble piping according to jurisdictional codes, engineered drawings and specifications using joining methods such as threading and welding

Task 13 — Installs steam heating systems.

Context Steamfitters/Pipefitters work on high and low pressure steam systems that provide comfort heating for residential, commercial and industrial buildings. They must install both piping and equipment and attach one to the other.

Required Knowledge

K 1	equipment such as boilers, condensate return pumps and converters
K 2	methods for joining equipment to piping
K 3	condensate removal systems
K 4	piping materials such as carbon steel and alloy steel
K 5	grades and sizes of pipe and fittings
K 6	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications
K 7	material ratings such as 150, 300, 600 and 900 lb, and their applications
K 8	piping components such as heat transfer units, valves and steam traps
K 9	pressure ranges required
K 10	thickness of insulation and pipe covering
K 11	coefficients of expansion on hangers, supports, guides and anchors
K 12	steam heating applications and systems
K 13	dangers associated with low and high pressure steam
K 14	thermodynamics of low and high pressure steam
K 15	pressure safety valves and water makeup systems
K 16	pressure rating of pipes and types of fittings
K 17	steam relief venting

K 18	piping practices such as the orientation of eccentric reducers, strainers, orifice plates and valves
K 19	approved jointing compounds for steam heating system piping

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Sub-task

E-13.01 Installs equipment for steam heating systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-13.01.01	select and use tools and equipment such as threading machines, and brazing, soldering and welding tools
E-13.01.02	select equipment and determine placement considering factors such as access, building size and environmental conditions
E-13.01.03	determine location of equipment such as water treatment, condensate tank, boiler, traps, strainer and expansion joints according to specifications and drawings
E-13.01.04	set equipment according to industry standards and manufacturers' specifications, engineered drawings and jurisdictional requirements
E-13.01.05	install equipment controls such as low water cut-offs, water gauges (sight glasses) and orifice plates
E-13.01.06	size steam system using methods such as performing heat loss calculations, and consulting engineered drawings and specifications
E-13.01.07	install safety components such as pressure safety valves and vent piping
E-13.01.08	install brackets and supports for equipment such as expansion tanks, pumps, outdoor controllers and control valves

Sub-task

E-13.02 Installs piping for steam heating systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-13.02.01	select and use tools and equipment such as threading machines, welders and pipe wrenches
E-13.02.02	determine type of piping and fittings according to engineered drawings
E-13.02.03	determine method of fabrication of joints
E-13.02.04	determine location of steam traps
E-13.02.05	calculate grade or pitch of piping according to engineered drawings and piping practices in order to ensure system efficiency and functionality
E-13.02.06	assess routing to ensure compliance with drawings and avoid interferences
E-13.02.07	install piping supports and brackets
E-13.02.08	install safety components such as pressure safety valves and vent piping
E-13.02.09	allow for insulation of steam lines using methods such as sleeving and proper spacing
E-13.02.10	assemble piping according to jurisdictional codes, engineered drawings and specifications using joining methods such as threading and welding

BLOCK F HEATING, COOLING AND PROCESS SYSTEM INSTALLATION

Trends	There are cleaner burning and more energy efficient systems in use. There is an increase in the use of chilled water systems in certain areas where large bodies of water are available as a medium for cooling.
Related Components (include, but not limited to)	Boilers, burners, incinerators, backflow preventers, pumps, vessels, cooling towers, chillers and heat exchangers, fuel systems, compressors, expansion tanks, generators, heaters, injectors, instrumentation controls, scrubbers, straightening vanes, supports, tanks, valves (balancing, shut-off, globe, flow control), isolators. **Piping materials:** high carbon steel, low carbon steel, alloy steel, cast iron, all stainless steel, duplex, super duplex, copper nickel, chrome molybdenum, monel, inconel, titanium, aluminium, internal/external lined and related piping materials, thermoplastics, thermosetting resins (fibreglass), copper, brass, bronze. **Instrumentation devices for temperature, pressure, level, flow:** control valves, control tubing, instrument air compressors, heating, ventilation and air conditioning (HVAC) systems, accessories for process systems.
Related Systems (include, but not limited to)	Pneumatics, combustible and non-combustible gas, vacuum, hydronic heating and cooling, boiler primary and secondary industrial burner control, HVAC and controls (includes chillers, refrigeration, cooling towers), instrumentation control (level, flow, temperature, pressure controls and devices), boiler burner (solid fuel, crude oil, fuel gas), boiler blowdown, boiler feedwater, water treatment, water purification, hydraulic, marine, process (such as pulp and paper, steel, food, pharmaceutical, petrochemical, nuclear), waste treatment, medical gas.
Tools and Equipment	See Appendix A.

Task 14 Installs hydronic systems.

Context This refers to the installation of "comfort" heating and cooling systems, including high temperature and low temperature hot water heating systems, chilled water cooling systems and cooling towers.

Required Knowledge

K 1	types of hydronic systems such as hot water, chilled water, condenser water and glycol
K 2	hot water boilers, converters and components
K 3	grades and sizes of pipe and fittings
K 4	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications
K 5	material ratings such as 150 and 300 lb, and their applications
K 6	chilled water systems and components such as cooling towers, water treatment components and pumps
K 7	calculations such as heat loss and heat transfer, system volume and head pressures
K 8	types of piping arrangements such as one-pipe, two-pipe (direct and reverse return), radiant panel and domestic inline water heaters
K 9	types of hangers for hydronic piping
K 10	valves and fittings used in hydronic systems
K 11	controls and wiring for hydronic heating and cooling systems
K 12	locations for heat transfer units
K 13	thickness of insulation and pipe covering
K 14	approved jointing compounds for hydronic system piping

Sub-task

F-14.01 Installs equipment for hydronic systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-14.01.01	select and use tools and equipment
F-14.01.02	identify high points for installation of equipment such as air vents and bleeders
F-14.01.03	size hydronic system using methods such as performing heat loss calculations, and consulting engineered drawings, jurisdictional codes and specifications
F-14.01.04	select equipment and determine placement considering factors such as access, building size and environmental conditions
F-14.01.05	install brackets and supports for equipment such as expansion tanks, pumps, outdoor controllers and control valves

Sub-task

F-14.02 Installs piping for hydronic systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-14.02.01	select and use tools and equipment such as grooving machines, threading machines and welding equipment
F-14.02.02	select piping and installation methods and materials according to specifications, jurisdictional codes and engineered drawings
F-14.02.03	assess routing to ensure compliance with drawings and to avoid interferences
F-14.02.04	allow for contraction and expansion of piping according to engineered drawings using methods such as installing sleeves, anchors, guides and hangers
F-14.02.05	clean and prepare fittings and joints to ensure fit-up and avoid leaks

F-14.02.06	use joining methods such as threaded pipe and threaded fittings, grooved pipe and mechanical joints, brazing, soldering and welding
F-14.02.07	allow for insulation of hydronic lines using methods such as sleeving and proper spacing

Task 15 Installs process piping systems.

Context These systems are used in specific industry processes, including, but not limited to, gas and oil refining, pulp production, mining, food processing and chemical production. These industry processes dictate the use of a wide variety of piping materials and joining methods.

Required Knowledge

K 1	types of equipment for process piping systems such as pumps, exchangers and vessels
K 2	composition of piping such as stainless steel, fibreglass and plastic
K 3	equipment function
K 4	grades and sizes of pipe and fittings
K 5	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications
K 6	material ratings such as 150, 300, 600 and 900 lb, and their applications
K 7	pipe accessories and components such as valves, strainers and expansion joints
K 8	various types of system mediums
K 9	applicable codes and specifications
K 10	seismic requirements as per jurisdictional regulations
K 11	bolt torquing and tensioning equipment
K 12	approved jointing compounds for process piping

Sub-task

F-15.01 Installs equipment for process piping systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-15.01.01	select and use tools and equipment
F-15.01.02	identify location for equipment according to engineered drawings
F-15.01.03	set, level, secure and support equipment such as pumps, exchangers, vessels and valves

Sub-task

F-15.02 Installs piping for process piping systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-15.02.01	select and use tools and equipment
F-15.02.02	determine type of piping and fittings such as stainless steel, carbon steel and plastic according to load, engineered drawings, jurisdictional codes and specifications
F-15.02.03	segregate pipe and material for installation according to specifications
F-15.02.04	avoid contact between metals of incompatible compositions (tools and materials) in order to prevent contamination or electrolysis
F-15.02.05	join pipe using methods such as welding, solvent welding, butt fusion and FRP lay-up
F-15.02.06	assess routing to ensure compliance with drawings and avoid interferences
F-15.02.07	install process piping components such as strainers, pipe hangers and spring hangers
F-15.02.08	install piping supports and brackets
F-15.02.09	align piping to equipment and connections in order to achieve required tolerances and prevent strain on equipment

Task 16 Installs hydraulic systems.

Context Hydraulic systems are used to drive hydraulic motors and actuators in a variety of industrial and manufacturing processes.

Required Knowledge

K 1	hydraulic system components such as reservoirs, valves and pumps
K 2	hydraulic principles
K 3	grades and sizes of pipe, tubing and fittings
K 4	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications
K 5	material ratings such as 150, 300, 600 and 900 lb, and their applications
K 6	hoses and connectors
K 7	pressure relief circuits
K 8	types of hydraulic fluids
K 9	support requirements for hydraulic piping
K 10	dangers associated with hydraulic systems
K 11	seismic requirements as per jurisdictional regulations
K 12	approved jointing compounds for hydraulic system piping

Sub-task

F-16.01 Installs equipment for hydraulic systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-16.01.01	select and use tools and equipment
F-16.01.02	identify location for equipment according to engineered drawings, jurisdictional codes and vendor specifications
F-16.01.03	set, level, secure and support equipment such as drive motors, gauges and actuators

Sub-task

F-16.02 Installs piping and tubing for hydraulic systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-16.02.01	select and use tools and equipment
F-16.02.02	determine type of piping and fittings such as stainless steel, carbon steel and hose according to pressure rating and engineered drawings
F-16.02.03	select joining methods such as welded, screwed and hose connectors according to piping materials
F-16.02.04	assess routing to ensure compliance with drawings and avoid interferences
F-16.02.05	apply jointing compounds in order to tighten connections and prevent leaks
F-16.02.06	bend tubing in order to route from one component to another
F-16.02.07	install piping supports and brackets

Task 17 Installs refrigeration systems.

Context According to jurisdictional guidelines, steamfitters/pipefitters install refrigeration equipment and piping for commercial, institutional and industrial applications such as food processing plants, recreational facilities, medical facilities, industrial manufacturing processes and liquefied natural gas plants. System components and design can vary depending on the type of refrigerant used.

Required Knowledge

K 1	refrigeration system components such as compressors, evaporators, expansion valves and condensers
K 2	supports and insulation requirements
K 3	applicable codes
K 4	types of piping and tubing for refrigeration systems such as plastic, air conditioning and refrigeration (ACR) copper and steel
K 5	grades and sizes of pipe, tubing and fittings
K 6	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications

K 7	material ratings such as 150, 300, 600 and 900 lb, and their applications
K 8	refrigerants such as ammonia and non-chlorinated products
K 9	refrigeration cycle
K 10	approved jointing compounds for refrigeration system piping

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Sub-task

F-17.01 Installs equipment for refrigeration systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV	NV	NV

Key Competencies

F-17.01.01	select and use tools and equipment
F-17.01.02	determine location for equipment by referring to engineered drawings
F-17.01.03	install equipment supports and fasteners to engineering and manufacturers' specifications
F-17.01.04	set equipment according to industry standards, manufacturers' specifications, engineered drawings and jurisdictional requirements

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Sub-task

F-17.02 Installs piping and tubing for refrigeration systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	no	yes	yes	yes	NV	NV	NV

Key Competencies

F-17.02.01	select and use tools and equipment such as flaring tools, swaging tools and tube benders
F-17.02.02	bend tubing in order to route from one component to another
F-17.02.03	assemble piping and tubing according to engineered drawings, jurisdictional codes and specifications using joining methods such as welding and brazing
F-17.02.04	prepare pipe using methods such as purging, reaming, flaring and cleaning ends
F-17.02.05	allow for insulation of refrigerant lines using methods such as sleeving and proper spacing

Task 18 — Installs fuel systems.

Context This refers to the installation of both liquid and gaseous fuel systems. Installation and certification requirements and regulations are governed at the provincial/territorial level and, therefore, vary across Canada.

Required Knowledge

K 1	applicable codes in area
K 2	burner types and operating principles
K 3	source of ignition
K 4	venting
K 5	grades and sizes of pipe and fittings
K 6	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications
K 7	material ratings such as 150, 300, 600 and 900 lb, and their applications
K 8	products of combustion
K 9	combustion air
K 10	controls
K 11	fuel storage and supply
K 12	types of fuels such as bunker C, natural gas and propane
K 13	regulators
K 14	fuel gas valves
K 15	colour coding systems for fuel piping such as yellow for natural gas and propane
K 16	approved jointing compounds for fuel system piping

Sub-task

F-18.01 Installs equipment for fuel systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-18.01.01	select and use tools and equipment
F-18.01.02	identify location for equipment according to engineered drawings, jurisdictional codes and vendor specifications
F-18.01.03	set, level and support equipment such as generators, tanks, burners and pumps

Sub-task

F-18.02 Installs piping for fuel systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-18.02.01	select and use tools and equipment
F-18.02.02	refer to applicable jurisdictional codes, standards and engineered drawings
F-18.02.03	select joining methods according to pipe medium
F-18.02.04	join pipe using methods such as welded, flared, brazed, flanged and threaded
F-18.02.05	assess routing to ensure compliance with drawings and avoid interferences
F-18.02.06	install piping supports and brackets

Task 19 — Installs medical gas systems.

Context Medical gas piping systems are addressed separately due to their unique installation methods and applications. Additional certification may be required in certain jurisdictions.

Required Knowledge

K 1	medical gas system equipment such as vacuum pumps and dryers
K 2	equipment controls such as pressure regulators, pressure switches and pressure relief valves
K 3	manifold assemblies
K 4	instrument air requirements
K 5	medical gas piping, tubing and related equipment
K 6	types of medical gases such as oxygen, air and nitrogen
K 7	importance of cleanliness of system
K 8	pin indexing and Diameter Index Safety System (DISS)
K 9	quick connect fittings
K 10	purge gases such as argon and nitrogen
K 11	approved jointing compounds for medical gas system piping

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Sub-task

F-19.01 Installs equipment for medical gas systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-19.01.01	select and use tools and equipment
F-19.01.02	determine location for equipment by referring to engineered drawings
F-19.01.03	install equipment supports and fasteners to engineering and manufacturers' specifications
F-19.01.04	set equipment according to manufacturers' specifications and engineered drawings

F-19.01.05	install equipment components such as medical gas panels, columns and terminal units
F-19.01.06	reference medical gas codes in order to ensure standards for installation are met

Sub-task

F-19.02 Installs piping and tubing for medical gas systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-19.02.01	select and use tools and equipment
F-19.02.02	select tubing appropriate for medical gas installations
F-19.02.03	clean piping, tubing and fittings to avoid contamination
F-19.02.04	assemble piping and tubing according to engineered drawings and specifications using joining methods such as brazing and threading
F-19.02.05	purge and charge piping and tubing to ensure it remains a closed system
F-19.02.06	install emergency shut-off valves according to engineered drawings
F-19.02.07	label entire system to clearly identify gas products in each line

Task 20 Installs compressed air systems.

Context Compressed air systems refer to instrument air, utility air and process air piping used in commercial, institutional and industrial settings.

Required Knowledge

K 1	compressed air system components such as compressors, compressed air dryers, filters and receiver tanks
K 2	certification requirements
K 3	utility air requirements
K 4	instrument air requirements
K 5	process air requirements
K 6	types of piping such as stainless steel, carbon steel, galvanized steel and copper

K 7	grades and sizes of pipe and fittings
K 8	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications
K 9	material ratings such as 150, 300, 600 and 900 lb, and their applications
K 10	tubing and hoses

Sub-task

F-20.01 **Installs equipment for compressed air systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-20.01.01	select and use tools and equipment
F-20.01.02	determine location for equipment by referring to engineered drawings
F-20.01.03	install equipment supports and fasteners to engineering and manufacturers' specifications, and jurisdictional codes
F-20.01.04	set equipment according to manufacturers' specifications, jurisdictional codes and engineered drawings

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Sub-task

F-20.02 **Installs piping and tubing for compressed air systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-20.02.01	select and use tools and equipment such as threaders and tube benders
F-20.02.02	select piping and tubing appropriate for compressed air installations
F-20.02.03	remove moisture from air supply
F-20.02.04	assemble piping and tubing according to engineered drawings, manufacturers' specifications and jurisdictional codes using joining methods such as welding and threading
F-20.02.05	install piping supports, brackets and instrument air trays
F-20.02.06	thread air lines to exact tolerances to avoid leaks

BLOCK G — RENEWABLE ENERGY SYSTEM INSTALLATION

Trends	There is an increase in the computerization and automation of the systems and equipment for efficiency, remote controlling, diagnostics and maintenance. There are newer compositions of materials and joining methods. More modularization to streamline installations has reduced costs. Due to the number of manufacturer-specific qualifications, steamfitters/pipefitters find themselves obtaining specialized certifications on a continuous basis.
Related Components (include, but not limited to)	Pumps, exchangers, reservoirs, gauges, meters, panels, cells, controls, computers, wells, valves.
Tools and Equipment	See Appendix A.

Task 21 — Installs geo-thermal systems.

Context

Geo-thermal systems harness energy from the ground and water, and deliver it through mechanical means to its intended destination. It encompasses environmentally sound practices, technologies and methodologies to generate energy. These systems create heating, cooling and electricity. Steamfitters/Pipefitters install these systems in multi-family residential, commercial, institutional and industrial settings.

Required Knowledge

K 1	installation certification according to jurisdictional codes and manufacturers' requirements
K 2	excavation permit requirements for installation as per local and jurisdictional requirements
K 3	general permitting requirements pertaining to respective jurisdictions
K 4	geo-thermal system components such as exchangers, controls and circulating pumps
K 5	grades and sizes of pipe and fittings

K 6	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications
K 7	material ratings such as 150, 300, 600 and 900 lb, and their applications
K 8	joining methods for materials such as HDPE and FRP
K 9	sub-atmospheric systems as they apply to different configurations
K 10	types of configurations such as surface, direct bore and binary
K 11	functionality of existing systems
K 12	integration with existing systems
K 13	vapour barriers
K 14	environmental standards for medium used in systems

Sub-task

G-21.01 Installs equipment for geo-thermal systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

Key Competencies

G-21.01.01	select and use tools and equipment such as fusion machines and shrink-fit devices
G-21.01.02	select equipment according to medium and load
G-21.01.03	determine equipment placement considering factors such as access, building size, environmental conditions and engineering specifications
G-21.01.04	install equipment supports and fasteners to engineering and manufacturers' specifications
G-21.01.05	set equipment according to industry standards and manufacturers' specifications, engineered drawings and jurisdictional requirements

Sub-task

G-21.02 Installs piping for geo-thermal systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

Key Competencies

G-21.02.01	select and use tools and equipment such as fusion machines, welding equipment and shrink-fit devices
G-21.02.02	select piping according to load and to medium conforming with environmental and jurisdictional regulations and standards
G-21.02.03	identify high points and install venting where needed
G-21.02.04	assemble piping according to engineered drawings and specifications using joining methods such as fusion, welding and shrink-fit
G-21.02.05	select and install process medium such as water, salt water and glycol for piping according to manufacturers' or engineer's guidelines

Task 22 Installs solar heating systems.

Context Solar systems harness energy from the sun and deliver it through means such as conduction, convection and radiation to its intended destination. It encompasses environmentally sound practices, technologies and methodologies to generate energy. These systems create heating, cooling and electricity. Steamfitters/Pipefitters install these systems in residential, commercial, institutional and industrial settings.

Required Knowledge

K 1	installation certification according to jurisdictional and manufacturers' requirements
K 2	engineering and manufacturer's guidelines for system installation
K 3	general permitting requirements pertaining to respective jurisdictions
K 4	solar heating system components such as exchangers, panels and cells
K 5	grades and sizes of pipe and fittings
K 6	pipe and fitting schedules such as Schedule 40 and Schedule 80, and their applications
K 7	material ratings such as 150 and 300 lb, and their applications

K 8	functionality of existing systems
K 9	integration with existing systems
K 10	environmental standards for medium used in systems
K 11	insulation methods and materials
K 12	vapour barriers
K 13	system placement and design limitations
K 14	joining methods for materials such as HDPE and copper
K 15	sub-atmospheric systems as they apply to different configurations

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Sub-task

G-22.01 Installs equipment for solar heating systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

Key Competencies

G-22.01.01	select and use tools and equipment such as brazing, soldering, fusion and compression fitting equipment
G-22.01.02	select equipment according to load and to medium conforming with environmental and jurisdictional regulations and standards
G-22.01.03	determine equipment placement considering factors such as access, building size, environmental conditions and engineering specifications
G-22.01.04	install equipment supports and fasteners to engineering and manufacturers' specifications
G-22.01.05	set equipment according to industry standards and manufacturers' specifications, engineered drawings and jurisdictional requirements

Sub-task

G-22.02 Installs piping for solar heating systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

Key Competencies

G-22.02.01	select and use tools and equipment such as fusion, compression, brazing, soldering and shrink-fit devices
G-22.02.02	select piping according to medium, load and environmental conditions
G-22.02.03	identify high points and install venting where needed
G-22.02.04	assemble piping according to engineered drawings and specifications using joining methods such as fusion, welding and shrink-fit
G-22.02.05	select and install process medium such as water, salt water and glycol for piping according to manufacturers' or engineer's guidelines

Task 23 Installs heat recovery systems.

Context Heat recovery systems harness energy from existing systems and deliver it through means such as conduction, convection and radiation to its intended destination. They transmit fluids to store as potential energy for future use. Steamfitters/Pipefitters install these systems in residential, commercial, institutional and industrial settings.

Required Knowledge

K 1	configurations of various heat recovery systems
K 2	heat recovery system components such as exchangers and pumps
K 3	grades and sizes of pipe and fittings
K 4	pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160, and their applications
K 5	material ratings such as 150, 300, 600 and 900 lb, and their applications
K 6	installation certification according to jurisdictional and manufacturers' requirements
K 7	engineering and manufacturer's guidelines for system installation
K 8	general permitting requirements pertaining to respective jurisdictions
K 9	environmental standards for medium used in systems

K 10	functionality of existing systems
K 11	integration with existing systems
K 12	insulation methods and materials

Sub-task

G-23.01 Installs equipment for heat recovery systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

G-23.01.01	select and use tools and equipment
G-23.01.02	select equipment according to medium and load
G-23.01.03	set equipment according to industry standards and manufacturers' specifications, engineered drawings and jurisdictional requirements
G-23.01.04	install equipment supports and fasteners to engineering and manufacturer's specifications
G-23.01.05	adhere to site specific installation guidelines

Sub-task

G-23.02 Installs piping for heat recovery systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

G-23.02.01	select and use tools and equipment
G-23.02.02	prepare installation area for new or add-on supports and piping
G-23.02.03	select piping according to medium, load and environmental conditions
G-23.02.04	assemble piping according to engineered drawings and specifications using joining methods
G-23.02.05	adhere to site-specific installation guidelines

BLOCK H TESTING AND COMMISSIONING

Trends

Commissioning crews are increasingly becoming involved in several phases of installation, rather than solely at the completion.

The turnover packages required prior to commissioning are becoming more detailed.

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 24 Prepares system for test.

Context

Steamfitters/Pipefitters must carefully pre-check and isolate the system prior to performing a system test. They must also select proper test equipment, reference system specifications and procedures, and include any accessories required.

Required Knowledge

K 1 pre-check list such as a punch list and specifications

K 2 types of test equipment such as dead weights, chart recorders, hydrostatic test pumps, safety relief valves, regulators and test gauges

K 3 system test requirements

K 4 test equipment operations

K 5 MSDS for testing medium

K 6 component limitations

K 7 connection points

K 8 types of accessories such as vents, drains and test headers

K 9 manufacturers' recommendations and jurisdictional regulations

Sub-task

H-24.01 Pre-checks system for test.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-24.01.01	identify system to be tested according to engineered drawings
H-24.01.02	select tools and equipment such as pipe wrench and combination wrench
H-24.01.03	perform a visual inspection of system to be tested to check for possible obstructions and deficiencies
H-24.01.04	verify test parameters according to engineer's specifications and jurisdictional codes
H-24.01.05	determine type of test such as hydrostatic, pneumatic or vacuum
H-24.01.06	complete pre-check list such as punch list in order to confirm all components are installed in the system
H-24.01.07	determine method of filling system such as using hand pump, centrifugal pump and plant water

Sub-task

H-24.02 Selects test equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-24.02.01	reference test procedures
H-24.02.02	reference drawings and specifications for determining test pressure, fill point, high point vents and drains
H-24.02.03	perform basic check of test equipment
H-24.02.04	select testing devices such as test blinds and test pumps, and calibrated gauges and relief valves
H-24.02.05	assemble components such as pressure relief valves, gauges, gate valves and testing trees

Sub-task

H-24.03 Isolates system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-24.03.01	lock out system in order to prevent activation during testing
H-24.03.02	install temporary spools according to engineer's specifications
H-24.03.03	install isolation components such as blinds, plugs and caps

Sub-task

H-24.04 Connects test equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-24.04.01	select and use tools and equipment for connection
H-24.04.02	install vents and drains on high points and low points
H-24.04.03	install test headers, test blinds, test pumps, and calibrated gauges and relief valves
H-24.04.04	connect test pumps or compressed air

Task 25 Performs test.

Context In order to ensure a secure system, steamfitters/pipefitters must test a system beyond normal operational requirements to satisfy necessary codes, regulations and quality control standards. This encompasses making repairs and corrections along the way.

Required Knowledge

K 1	securing procedures such as identifying and roping off areas according to company procedures
K 2	pipe and fitting schedules such as Schedule 40 and Schedule 80, and their applications
K 3	material ratings such as 150 and 300 lb, and their applications
K 4	test area radius
K 5	testing pressure
K 6	test parameters
K 7	types of defects such as bent valve stems, faulty gaskets and loose packing bolts
K 8	medium handling procedures according to MSDS or company policies
K 9	test solution disposal and recovery methods
K 10	test equipment handling procedures

Sub-task

H-25.01 Secures test area.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-25.01.01	communicate and coordinate scheduled test with others
H-25.01.02	clear area of personnel
H-25.01.03	rope off test area and put up signage

Sub-task

H-25.02 Pressurizes system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-25.02.01	fill system and vent
H-25.02.02	increase pressure in stages to maximum test pressure, and hold for prescribed duration according to test plan, engineering specifications, and jurisdictional requirements
H-25.02.03	interpret temperature and pressure gauge readings

Sub-task

H-25.03 Inspects system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-25.03.01	perform visual inspection of test parameters
H-25.03.02	detect defects such as faulty gaskets and loose packing bolts
H-25.03.03	report defects to supervisor
H-25.03.04	reference engineered drawings and test plan
H-25.03.05	analyze defect in order to recommend repair
H-25.03.06	obtain witness verification and sign-off for successful test once there are no defects

Sub-task

H-25.04 Corrects leaks.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-25.04.01	depressurize system
H-25.04.02	tighten and torque flanges
H-25.04.03	remove and replace faulty components such as valves, flanges, nuts, bolts and fittings
H-25.04.04	repair faulty joints such as welded and threaded

Sub-task

H-25.05 Removes test equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-25.05.01	depressurize and drain system by opening drains at low points and opening high point vents
H-25.05.02	recover and dispose of test solutions
H-25.05.03	reinstate system by disconnecting test equipment and installing items such as gaskets and original components
H-25.05.04	remove signage and barricades

Task 26 Commissions systems.

Context Commissioning systems involves bringing the piping systems online. This can be done in collaboration with owners' representatives or AHJ.

Required Knowledge

K 1 MSDS for flushing medium

K 2 operation and components of system

K 3 engineered drawings and specifications

Sub-task

H-26.01 Flushes system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-26.01.01 clean pipe according to engineer's or manufacturers' specifications using chemicals such as chlorine and acids

H-26.01.02 install temporary pipe for delivering flushing medium

H-26.01.03 follow flushing procedure according to engineer's or manufacturers' specifications

H-26.01.04 identify equipment to be protected from flushing medium

H-26.01.05 recover and dispose of flushing medium

Sub-task

H-26.02 Chemically treats system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-26.02.01	follow treatment procedures such as cycling, length of time and pressure
H-26.02.02	identify which lines require chemical treatment according to owner's request and engineer's specifications
H-26.02.03	remove and install components such as pipe, valves and fittings for temporary piping
H-26.02.04	install temporary pipe for delivering chemical treatment
H-26.02.05	obtain a sample of the treated medium for testing

Sub-task

H-26.03 Participates in start-up procedure.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-26.03.01	select and use tools and equipment
H-26.03.02	follow start-up procedure list
H-26.03.03	reinstall controls and equipment
H-26.03.04	install additional trim such as check valve flaps, burners and control valves
H-26.03.05	fill system to operational level
H-26.03.06	check equipment/trim function and safety features
H-26.03.07	demonstrate system operation with the owner's representative
H-26.03.08	review valve identification tags
H-26.03.09	apply pipe markings to identify flow and medium

BLOCK I — MAINTENANCE AND REPAIR

Trends

For better time efficiency and cost-effectiveness, and reduced downtime, it is more common to replace rather than repair components. They may be upgraded with components made with new materials and of different sizing. There is also an increase in the use of composite crews (multiple trades working together).

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 27 — Maintains system.

Context

Steamfitters/Pipefitters are responsible for the maintenance of piping, components and equipment. Maintenance is done on a regular schedule or on an emergency basis to ensure productivity and durability of the piping system. There are jurisdictional regulations and manufacturers' specifications that demand maintenance on a specific schedule.

Required Knowledge

K 1	types of piping systems being worked on
K 2	types of site-specific lock-out procedures such as mechanical and electrical according to owner and jurisdictional requirements
K 3	components that require lock-out such as pumps, valves and electrical panels
K 4	scheduled maintenance requirements
K 5	various types of system mediums
K 6	types of joining materials such as gaskets and fasteners
K 7	types of lubricants
K 8	specifications related to the existing system
K 9	types and applications of valves
K 10	maintenance and rebuilding procedures for valves on job site
K 11	required training for lock-out according to owner and jurisdictional requirements

K 12	time limitations for performing maintenance procedures
K 13	lock-out equipment such as lockboxes, chains and multi-lock scissors
K 14	flushing and treating systems

Sub-task

I-27.01 Follows lock-out procedures.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

I-27.01.01	obtain designated lock-out equipment such as lock and key, chains and tags, and use according to owner and jurisdictional requirements
I-27.01.02	complete required documentation such as lock-out/tag-out, quality control reports and tool box meeting reports
I-27.01.03	apply isolation methods such as double-block-and-bleed and blinding
I-27.01.04	verify that system is isolated (zero energy state) by methods such as opening low point valves, checking gauges and switches, and inspecting sight glasses
I-27.01.05	remove lock-out equipment once activity is completed

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Sub-task

I-27.02 Performs preventative maintenance and service.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

I-27.02.01	follow a predetermined maintenance schedule
I-27.02.02	create a tool and material list
I-27.02.03	obtain work permits to perform activities such as shutting down of system and performing hot work
I-27.02.04	plan for storage and handling of medium being removed from system
I-27.02.05	complete documentation as required
I-27.02.06	perform activities such as depressurizing and draining system, securing area and isolating system

I-27.02.07	inspect and clean components such as strainers, filters, traps and drains
I-27.02.08	lubricate components such as valves, pumps and soot blowers
I-27.02.09	reuse or dispose of medium
I-27.02.10	reenergize system with new or removed medium
I-27.02.11	perform inspection of piping and equipment such as valves, gauges and pumps
I-27.02.12	treat system with chemicals

Task 28 Performs repairs.

Context Steamfitters/Pipefitters are responsible for diagnosing, locating and repairing or replacing equipment and material. Repairs comply with owner requirements and jurisdictional regulations. Repairs are performed on an as-needed basis.

Required Knowledge

K 1	potential piping problems such as connection leaks, gasket failures and valve failures
K 2	potential equipment problems such as leaking boiler components, leaking connections and faulty emergency shut-off valves
K 3	potential component problems such as passing valves, leaking packings, bent valve stems and faulty steam traps
K 4	piping system and medium
K 5	components to be replaced such as gaskets and valves
K 6	bypass systems to assist in performing repairs

Sub-task

I-28.01 Diagnoses problems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

I-28.01.01	isolate system if necessary
I-28.01.02	use tools and equipment such as holiday detector (GEEP™ tester), infrared temperature sensor and manometer
I-28.01.03	inspect system for conditions such as temperature, leaks, corrosion, vibration and irregular movement
I-28.01.04	locate problem using tests such as wall thickness test and hydrostatic test
I-28.01.05	generate reports describing deficiencies in system

Sub-task

I-28.02 Repairs piping and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

I-28.02.01	select and use tools and equipment
I-28.02.02	verify components to be repaired or replaced according to available drawings and specifications
I-28.02.03	receive permits to allow work
I-28.02.04	shut down, lock out and drain system
I-28.02.05	dispose of or store medium
I-28.02.06	disassemble system by removing and replacing piping and components
I-28.02.07	follow regulations and policies governing repairs such as confined space regulations and weld procedures
I-28.02.08	apply interim repairs to piping and components such as vessels and exchangers
I-28.02.09	test and check repairs
I-28.02.10	energize system using new or existing medium

APPENDICES

APPENDIX A TOOLS AND EQUIPMENT

Hand Tools

alignment clamps – external and internal
angle finder
bending tools – hand and hydraulic
bolt cutter
bolt die
bolt tap
C-clamp
calculator
centre punch
chain pipe tongs
coil fin straightener
cold chisels
computer
contour markers
drafting accessories
files
flange alignment pins
flange spreader(jacks)
flaring tool
freeze pack
gasket cutter
hacksaws – hand, portable band, large band
hammers – ball peen, chipping, sledge, soft-face
hand beveller
hi-lo gauge
hole punch
levels – laser, standard, builders, digital (smart)
marking tool
pin bars
pin punch
pipe cutters – single-wheel, multi-wheel
pipe reamer – spiral, fluted
pipe tap
pipe threader
pipe vises – chain and yokes, tri-stand and bench, power vise (power drive)
pliers
prying tool
ratchet
screwdrivers
shear
shrink-fit device
spacing tool
strapping device
swaging tool
tip cleaner
tube cleaner
tube bender
wheel and bearing pullers
wrap-around
wrenches – adjustable, chain, combination (open-/closed-end), hammer, hex-key, non-spark, pin, pipe, socket, torque

Power Tools

air compressor
bending machine
bevelling tools – electric drive, pneumatic, oxy-fuel
bolt tensioner
drills – electric, pneumatic, hammer, bench or stand press, mag
facing tool
grinders (electric or pneumatic) angle, bench, die, pedestal
grooving machine
hydraulic flange spreaders
hydraulic jacks
hydraulic torque wrench
hydrostatic pump
impact driver

Power Tools (continued)

portable end-prep milling – pneumatic, electric
powder-actuated tools
saws – circular, cut-off, jig, sabre
threading machine

Measuring and Testing Tools and Devices

ampere probe
calculator
callipers
centre finder
chart recorders
compass
dead weights
feeler gauge
gauges – temperature, pressure, liquid, vacuum, specialty, pressure differential
geometry set
holiday detector (GEEP™ tester)
hydrostatic test pump
infrared temperature sensor
levels – laser, standard, builders (transit), digital (smart)
manometer
measuring tape
micrometer
multimeter
plumb bob
rulers
squares – standard 24-in., combination, flange straightedge, rigging
string line
tachometer
thermometer

Rigging and Hoisting Equipment

beam clamps
cable clips
cable puller
chain block
chain fall
chain puller
come-along
cranes
D ring
eye bolts
forklift
grip hoist (Tirfors™)
hooks
jacks (hydraulic, ram and piston)
rope
shackle
slings (nylon, wire rope, wire mesh)
snatch block
softeners
spreader bar
tag line
tugger

Welding, Soldering and Brazing Equipment

arc welders (electric, fuel)
compressed gas cylinders (purge, shield, cutting)
flashback arrestor
fusion welding equipment
hot air welding machine
orbital welder
plasma cutters
plastic fusion welding equipment
propane tiger torches (preheating)
regulator
temperature stick
torches (oxy-fuel cutting, heating and welding)
welding machines (SMAW, GMAW, TIG)

Ladders, Stands and Platforms

combination ladder
extension ladder
manlifts – electrical, hydraulic, pneumatic, winch (hand and power), one-man, platform, scissor lift, articulating boom
material lifts
scaffolding (staging)
pipe racks
pipe stands – roller and V type
platform ladder
step ladder

Personal Protective Equipment (PPE) and Safety Equipment

air quality monitors
anti-vibration gloves
breathing apparatus
chemical protective clothing
coveralls (standard and fire retardant)
dust mask
ear protection
electrically rated face shield
electrically rated gloves
face shield
fall arrest harness
fire extinguisher
first aid kit
fume extractor
hard hat
leather apron
leather gloves and sleeves
respirator
rubber gloves
safety boots
safety glasses
safety vest/gauntlets
welding goggles and helmet

APPENDIX B GLOSSARY

backflow preventer	a device or a method that prevents a reverse flow from the normal direction of flow in a piping system
balancing valve	valve used on hydronic systems to give each circuit the same pressure drop due to friction loss
blowdown	a connection at the bottom or lowest portion of a gauge glass, low water cutoff, automatic water feeder, cast iron water column, etc., to facilitate cleaning out or testing of the equipment
boiler	equipment used to create hot water or steam for heating, processing or energy
boiler trim	the controls, equipment and accessories connected to a boiler for its safe and efficient operation
butt fusion	a joining method that requires ends of pipe to be joined by direct heat application on material such as steel or plastic
CAD	computer-aided design; used for drawing, altering and recalling views and details on a computer
chilled water system	piping systems for cooling buildings, equipment or processes by circulating chilled water
circuit	the piping path from a boiler or heat exchanger to a heat transfer unit and back to the boiler
condensate return system	a piping arrangement designated to return condensate to a steam generator
contour marker	instrument used in the fabrication of pipe that will trace lines for the cutting of tees, wyes and laterals
control valve	a globe-type valve which controls the flow of a liquid or gas automatically as directed by an electrical or pneumatic signal or a capillary tube; it may be a single or double seated valve
controller	device with a sensing element which takes measurements and adjusts the setting of a preselected component accordingly

converter	a piece of equipment used to heat or cool water and other liquids by means of steam, high temperature hot water, or chilled water without the two mediums coming in contact with each other (such as heat exchanger, indirect heater)
deaerator	a device used to heat the feedwater before it enters the steam boiler. It may be used for reducing thermal shock, saving of fuel, removing temporary hardness and unwanted gases (such as oxygen and carbon dioxide) from the make-up water
desuperheater	a device which uses water as a cooling medium to lower the temperature of the superheated steam
direct return	a two-pipe heating system (hydronic system) in which the first unit supplied has the shortest return to the boiler
double-block-and-bleed	a valving system wherein a full flow vent valve is located on piping between two shut-off valves in series for the purpose of bleeding to the atmosphere excess pressure between valves
drip leg	a piping arrangement by which condensate accumulation is handled or removed in a steam system
dry return	a steam condensate return line which is carrying only steam
expansion joint	a manufactured, mechanical device to take up or to compensate for the expansion and contraction of a pipe line due to temperature change
feed water	water that is fed into a boiler
flashback	flashback always occurs in the line carrying the lower pressure and will always occur beyond the mixer, and may include the hose and regulator as well. It is usually a devastating explosion or series of explosions, leaving the equipment in shambles
heat exchanger	a device for transferring heat from one fluid to another without mixing the two fluids
heat transfer unit	a device used to transfer heat from a fluid to a space for conduction, convection or radiation
high temperature hot-water system	a system which has hot water above 350°F (180°C)
indicator	an instrument that shows a measurement, but makes no permanent record such as pressure gauge

isolator	a device used to isolate equipment from its piping for testing or flushing purposes; isolators are also used to give separation from its support to prevent the transmission of noise and/or vibration
low water cutoff	a device which shuts off the automatic fuel control valve when the water falls below a safe level in the boiler
make-up water	water supplied to a system that replaces system fluid that has been lost through evaporation, leakage, etc.
pin indexing	refers to a fail-safe design by which end connections for specific gasses can only be connected to other ends intended for use with the same gas; for example, equipment intended to utilize oxygen cannot physically be connected to a nitrous oxide gas supply
post heating	use of a heat source to heat an area after a process such as welding takes place
preheating	use of a heat source to heat an area before a process such as welding takes place
resin	a bonding agent used in the fibreglass process; used because of its resistance to acids and alkalines
safety relief valve	a safety device that will open before a dangerous pressure or temperature is reached
saturated steam	steam which is at the same temperature as the boiling water from which it was formed (dry saturated; wet saturated)
single-seated control valve	a control valve with a single seat and a single plug or disc
solvent fusion	joining plastic pipe by the use of a solvent which dissolves the surface of the pipe and forms a continuous bond upon evaporation
soot blower	a device which blows the soot off the tubes in the boiler with the use of steam
spool sheets	detail views of a piping system identifying specific piping and pieces to be fabricated
spreader bar	a bar that keeps a set of slings from closing up around a piece of equipment and doing damage when in the process of lifting
spreaders	a set of chokers or slings of equal length used to lift a load
steam separator	a device used to remove entrained moisture present in steam

steam tracing	a pipe or tube which is placed along or around pipe, vessels and pumps and is filled with steam to control the primary pipe's medium's temperature
steam trap	an automatic device which allows the passage of air and condensate but prevents the passage of steam
straightening vanes	device used to take the turbulence out of liquids and gases flowing in pipes so measuring instruments can get an accurate reading
superheated steam	saturated steam with the addition of sensible heat; an increase in temperature of saturated steam without an increase in pressure
superheater	a device used to reheat dry or wet-saturated steam and increase the temperature without increasing the pressure of the steam
vacuum pump	a device used to lower atmospheric pressure inside a vessel or piping system, it is highly efficient and needs a water seal to produce near-perfect vacuum
wrap-around	a coil of gasket material used to wrap around pipe, when in the process of marking a pipe

APPENDIX C

ACRONYMS

ACR	air conditioning and refrigeration
CAD	computer-aided design
DISS	Diameter Index Safety System
FRP	fibreglass reinforced plastic
GMAW	gas metal arc welding
HDPE	high density polyethylene
HVAC	heating, ventilation and air conditioning
MSDS	Material Safety Data Sheet
NDT	non-destructive testing
OH&S	Occupational Health and Safety
P&ID	process and instrumentation drawings
PEX	cross linked polyethylene
PPE	personal protective equipment
PVC	polyvinyl chloride
SMAW	shielded metal arc welding
TIG	tungsten inert gas
WHMIS	Workplace Hazardous Materials Information System

APPENDIX D BLOCK AND TASK WEIGHTING

BLOCK A OCCUPATIONAL SKILLS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	10	5	10	10	5	8	20	5	10	20	NV	NV	NV	10%

Task 1 Performs safety-related functions.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	33	20	30	29	20	18	15	25	40	30	NV	NV	NV	26%

Task 2 Uses and maintains tools and equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	33	50	30	37	60	55	40	50	20	50	NV	NV	NV	42%

Task 3 Organizes work.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	34	30	40	34	20	27	45	25	40	20	NV	NV	NV	32%

BLOCK B DRAWINGS AND SPECIFICATIONS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	13	15	10	11	5	8	20	11	15	15	NV	NV	NV	12%

Task 4 Interprets drawings and specifications.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	60	60	80	67	50	50	70	71	70	65	NV	NV	NV	64%

Task 5 Produces drawings.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	40	20	33	50	50	30	29	30	35	NV	NV	NV	36%

BLOCK C LAYOUT, FABRICATION AND INSTALLATION

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	17	20	15	16	10	15	10	14	15	15	NV	NV	NV	15%

Task 6 Performs layout and fabrication.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	40	60	39	33	45	60	30	40	50	NV	NV	NV	44%

Task 7 Performs common installation processes.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	40	30	39	34	45	35	41	40	35	NV	NV	NV	38%

Task 8 Installs tracing systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	20	10	22	33	10	5	29	20	15	NV	NV	NV	18%

BLOCK D RIGGING AND HOISTING

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	10	12	5	12	10	6	10	11	15	8	NV	NV	NV	10%

Task 9 Plans lift.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	50	75	50	50	60	70	46	75	65	NV	NV	NV	58%

Task 10 Hoists load.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	60	50	25	50	50	40	30	54	25	35	NV	NV	NV	42%

BLOCK E STEAM SYSTEM INSTALLATION

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	16	12	20	15	20	18	15	15	20	15	NV	NV	NV	17%

Task 11 Installs low pressure process steam systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	30	40	35	20	34	15	34	35	35	NV	NV	NV	32%

Task 12 Installs high pressure process steam systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	40	30	36	60	33	60	41	35	35	NV	NV	NV	39%

Task 13 Installs steam heating systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	30	30	29	20	33	25	25	30	30	NV	NV	NV	29%

BLOCK F HEATING, COOLING AND PROCESS SYSTEM INSTALLATION

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	16	20	20	13	20	26	15	13	10	9	NV	NV	NV	16%

Task 14 Installs hydronic systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	25	40	50	18	20	40	50	25	5	20	NV	NV	NV	29%

Task 15 Installs process piping systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	25	20	10	17	50	25	15	35	70	30	NV	NV	NV	30%

Task 16 Installs hydraulic systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	10	8	10	14	5	5	1	8	5	15	NV	NV	NV	8%

Task 17 Installs refrigeration systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	5	8	10	8	5	5	1	7	5	5	NV	NV	NV	6%

Task 18 Installs fuel systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	5	8	10	15	5	10	15	6	5	5	NV	NV	NV	8%

Task 19 Installs medical gas systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	10	8	5	14	5	10	15	8	5	5	NV	NV	NV	9%

Task 20 Installs compressed air systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	8	5	14	10	5	3	11	5	20	NV	NV	NV	10%

BLOCK G RENEWABLE ENERGY SYSTEM INSTALLATION

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	4	4	5	6	7	7	2	5	5	4	NV	NV	NV	5%

Task 21 Installs geo-thermal systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	34	40	30	36	20	34	20	19	0	30	NV	NV	NV	26%

Task 22 Installs solar heating systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	33	30	25	32	20	33	10	23	0	30	NV	NV	NV	24%

Task 23 Installs heat recovery systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	33	30	45	32	60	33	70	58	100	40	NV	NV	NV	50%

BLOCK H TESTING AND COMMISSIONING

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	7	8	5	8	15	5	5	14	5	6	NV	NV	NV	8%

Task 24 Prepares system for test.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	30	30	36	20	30	50	41	35	50	NV	NV	NV	36%

Task 25 Performs test.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	30	30	30	34	40	30	10	31	35	30	NV	NV	NV	30%

Task 26 Commissions systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	30	40	40	30	40	40	40	28	30	20	NV	NV	NV	34%

BLOCK I MAINTENANCE AND REPAIR

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	7	4	10	9	8	7	3	12	5	8	NV	NV	NV	7%

Task 27 Maintains system.

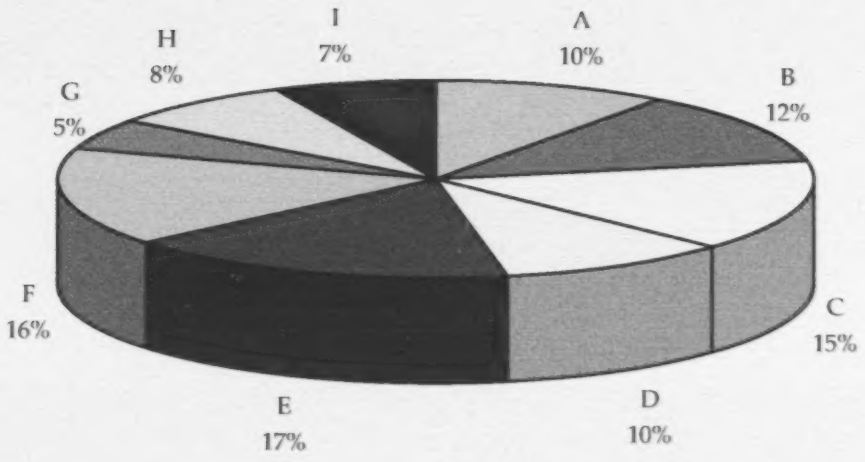
	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	50	50	47	50	50	40	44	70	40	NV	NV	NV	48%

Task 28 Performs repairs.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	60	50	50	53	50	50	60	56	30	60	NV	NV	NV	52%

APPENDIX E

PIE CHART*



TITLES OF BLOCKS

BLOCK A	Occupational Skills	BLOCK F	Heating, Cooling and Process System Installation
BLOCK B	Drawings and Specifications	BLOCK G	Renewable Energy System Installation
BLOCK C	Layout, Fabrication and Installation	BLOCK H	Testing and Commissioning
BLOCK D	Rigging and Hoisting	BLOCK I	Maintenance and Repair
BLOCK E	Steam System Installation		

* Average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. Interprovincial examinations typically have from 100 to 150 multiple-choice questions.

APPENDIX F

TASK PROFILE CHART — Steamfitter/Pipefitter

BLOCKS	TASKS	SUB-TASKS				
A - OCCUPATIONAL SKILLS	1. Performs safety-related functions.	1.01 Maintains safe work environment.	1.02 Uses personal protective equipment (PPE) and safety equipment.			
	2. Uses and maintains tools and equipment.	2.01 Uses ladders and work platforms.	2.02 Maintains tools and equipment.	2.03 Uses welding equipment.	2.04 Uses soldering and brazing equipment.	2.05 Uses oxy-fuel equipment.
	3. Organizes work.	3.01 Plans a job.	3.02 Generates material list.	3.03 Performs quality control functions.		
B - DRAWINGS AND SPECIFICATIONS	4. Interprets drawings and specifications.	4.01 Compares specifications to drawings.	4.02 Refers to types of drawings.			
	5. Produces drawings.	5.01 Generates drawings.	5.02 Develops templates.			
C - LAYOUT, FABRICATION AND INSTALLATION	6. Performs layout and fabrication.	6.01 Lays out pipe and fittings.	6.02 Fabricates piping spools.	6.03 Fabricates brackets, supports, hangers, guides and anchors.		
	7. Performs common installation processes.	7.01 Installs piping system components and equipment.	7.02 Installs brackets, supports, hangers, guides and anchors.			
	8. Installs tracing systems.	8.01 Installs steam tracing.	8.02 Installs liquid-filled tracing systems.			

BLOCKS	TASKS	SUB-TASKS				
D - RIGGING AND HOISTING	9. Plans lift.	9.01 Determines load.	9.02 Selects rigging and hoisting equipment.	9.03 Prepares lift plan.		
	10. Hoists load.	10.01 Conducts rigging and hoisting equipment inspection.	10.02 Secures lift area.	10.03 Sets up rigging equipment.	10.04 Performs lift.	10.05 Stores equipment.
E - STEAM SYSTEM INSTALLATION	11. Installs low pressure process steam systems.	11.01 Installs equipment for low pressure process steam.	11.02 Installs piping for low pressure process steam.			
	12. Installs high pressure process steam systems.	12.01 Installs equipment for high pressure process steam.	12.02 Installs piping for high pressure process steam.			
	13. Installs steam heating systems.	13.01 Installs equipment for steam heating systems.	13.02 Installs piping for steam heating systems.			
F - HEATING, COOLING AND PROCESS SYSTEM INSTALLATION	14. Installs hydronic systems.	14.01 Installs equipment for hydronic systems.	14.02 Installs piping for hydronic systems.			
	15. Installs process piping systems.	15.01 Installs equipment for process piping systems.	15.02 Installs piping for process piping systems.			
	16. Installs hydraulic systems.	16.01 Installs equipment for hydraulic systems.	16.02 Installs piping and tubing for hydraulic systems.			
	17. Installs refrigeration systems.	17.01 Installs equipment for refrigeration systems.	17.02 Installs piping and tubing for refrigeration systems.			

BLOCKS	TASKS	SUB-TASKS				
	18. Installs fuel systems.	18.01 Installs equipment for fuel systems.	18.02 Installs piping for fuel systems.			
	19. Installs medical gas systems.	19.01 Installs equipment for medical gas systems.	19.02 Installs piping and tubing for medical gas systems.			
	20. Installs compressed air systems.	20.01 Installs equipment for compressed air systems.	20.02 Installs piping and tubing for compressed air systems.			
G - RENEWABLE ENERGY SYSTEM INSTALLATION	21. Installs geo-thermal systems.	21.01 Installs equipment for geo-thermal systems.	21.02 Installs piping for geo-thermal systems.			
	22. Installs solar heating systems.	22.01 Installs equipment for solar heating systems.	22.02 Installs piping for solar heating systems.			
	23. Installs heat recovery systems.	23.01 Installs equipment for heat recovery systems.	23.02 Installs piping for heat recovery systems.			
H - TESTING AND COMMISSIONING	24. Prepares system for test.	24.01 Pre-checks system for test.	24.02 Selects test equipment.	24.03 Isolates system.	24.04 Connects test equipment.	
	25. Performs test.	25.01 Secures test area.	25.02 Pressurizes system.	25.03 Inspects system.	25.04 Corrects leaks.	25.05 Removes test equipment.
	26. Commissions systems.	26.01 Flushes system.	26.02 Chemically treats system.	26.03 Participates in start-up procedure.		

BLOCKS	TASKS	SUB-TASKS	
I - MAINTENACE AND REPAIR	27. Maintains system.	27.01 Follows lock-out procedures.	27.02 Performs preventative maintenance and service.
	28. Performs repairs.	28.01 Diagnoses problems.	28.02 Repairs piping and components.